DOCUMENT RESUME

ED 228 441 CE 035 571

AUTHOR Wass, Hannelore; Olejnik, Stephen F.
TITLE An Analysis and Evaluation of Research in Cognition and Learning among Older Adults.
PUB DATE 14 Apr 83
NOTE 25p.; Presented at the Annual Meeting of the American Educational Research Association (67th, Montreal, Canada, April 14, 1983).
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Education; *Adult Learning; Adult Programs; *Age Differences; *Aging (Individuals); *Cognitive Ability; Educational Research; Evaluation; Literature Reviews; *Memory; Older Adults; Program Development; *Research Problems

ABSTRACT

The research literature on aging was reviewed to determine findings with direct implications for educational programs for older persons and findings with no direct application but that raise further research questions. The focus was on cognition and learning in later life, predominantly on work published during the past two decades in major professional journals and psychological handbooks on aging or on developmental psychology. Research studies showed age-related cognitive declines. Problems with the studies that investigated cognitive abilities were the research design, the relevance of the tasks that participants were asked to perform, and the emphasis placed on speed in performance-related research. The research literature did not provide a clear answer regarding a decline in learning or remembering information provided through a written prose format. Serious methodological problems limiting the generalizability of the laboratory research were the relevance of the research task, the method used to assess learning and memory, and the readability level of the learning passage versus the participants' reading levels. Overall, the generalizability of the research was extremely limited. It was suggested that laboratory research on cognition and learning be followed by field research assessing learning abilities and cognitive function in the actual educational setting. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED228441

AN ANALYSIS AND EVALUATION OF RESEARCH IN COGNITION AND LEARNING AMONG OLDER ADULTS

Hannelore Wass

and

Stephen F. Olejnik

Paper Prepared for 1983 Annual Meeting of the American Educational Research Association, April 14, 1983, Montreal, Canada

CE035571

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

H Wass

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ABSTRACT

This paper reviews research literature to determine what findings, if any, have direct implications for educational programs for elderly persons; what findings have little or no application to such programs and what additional research is indicated in order to answer critically relevant practical questions. The paper is focused primarily on research literature on cognition and learning in later life, predominantly work published during the past two decades in major professional journals and psychological handbooks on aging or on developmental psychology. The analysis presented herein shows that, in general, researchers fall far short of providing useful information to practitioners in the field of education for elderly persons. The generalizability of recent research on cognition and learning is extremely limited. It is strongly suggested that though laboratory research on cognition and learning is a first step in gathering information about the subject, it must be followed by research conducted in the field where learning abilities and cognitive function can be assessed in the actual educational setting.

Introduction

Over the past decade the number and kinds of educational programs for older persons have increased significantly. So, too, has the number of older persons participating in such programs. (For the purposes of our discussion, we will consider individuals over the age of 60 as older persons.) There are many reasons for this new development including a recent emphasis on lifelong education, an interest in career changes and the development of a second career, interest in avocations, early retirement, concern for improved health and maintainance of independence in light of increased life expectancy, to name just a few. This increase in education for elderly individuals has raised interesting questions and problems for educational practicioners.

For example, one set of questions that has generated controversy is whether or not older individuals are capable of functioning intellectually at the same level as younger individuals. If not, is the discrepancy great enough to justify the segregation of old from young learners? Does the reduction in cognitive functioning limit the type of programs that older persons could find beneficial? Further, are older persons limited in their problem solving skills? Can these skills be taught? A second set of questions that is important to program developers involves the limitations of learning and memory among older persons.

One potential source of answers to these questions is the research literature on aging. An enormous research literature dealing with the cognition of older persons, their learning abilities, and related variables exists. This wealth of information, however, has apparently not been incorporated into the literature on practical programs. The purpose of this paper is to review the research literature and to see what findings, if any, have direct implications for educational programs for older persons, and what findings seem to have

no direct application, but which raise further research questions that need to be answered before they can be of practical use. This is not the first attempt to link research findings with educational programs in the area of educational gerontology. Elias (1974), Hickey and Spinetta (1974), Urban and Watson (1974), Peterson (1978), and Taub (1980), for example, have discussed this concern and urged both researchers and practicioners to work together more closely.

The review presented in this paper is focused primarily on the research literature on cognition and learning in later life, predominantly on work published during the past two decades in major professional journals or in several handbooks on the psychology of aging or on developmental psychology. Through an analysis of this literature it is shown that researchers are still far from providing useful information to practicioners and the generalizability of recent research on cognition and learning is extremely limited.

Cognitive Abilities

One of the primary questions that educators of older persons have is "Do cognitive abilities remain stable or do they decline with age?" This question has interested researchers for many years and its answer seems to depend on several factors including 1) the definition of intelligence, 2) the means by which intelligence is assessed, and 3) the research design used to answer the question.

A popular conceptualization of intelligence has been provided by Cattell (1963) and Horn (1978). These theorists have proposed a model of intelligence having two components, one component fluid, the other crystallized. Fluid intelligence refers primarily to species-wide physiological, maturational

abilities that are approximately the same as performance abilities (i.e., perceptual-motor, spatial, speed, etc.). Crystallized intelligence, on the other hand, refers to culturally transmitted abilities that are approximately the same as verbal abilities. Consistent with this conceptualization of intelligence, researchers have found that when verbal abilities (crystallized intelligence) are measured by subtests from standardized instruments such as the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1948) or the test of Primary Mental Abilities (PMA) (Thurstone & Thurstone, 1949) in large-sample, cross-sectional studies, only a slight drop in performance is observed through most of life (e.g., Birren & Morrison, 1961; Horn & Cattell, 1967). A more severe drop, however, is identified when individuals reach the age of 60 and thereafter (Doppelt & Wallace, 1955). In contrast, fluid intelligence as measured by perceptual-motor and other nonverbal subtests has been observed to begin to decline in early adulthood and continue to drop throughout life (E.g., Birren & Morrison, 1961; Doppelt & Wallace, 1955; Horn & Cattell, 1967).

These conclusions concerning cognitive functioning, however, have been challenged by several investigators (Schaie, 1958; Schaie & Strother, 1968). Schaie and his associates dispute the early decline in performance abilities. They found that certain performance abilities such as spatial abilities reach their peak in middle rather than early adulthood and decline less steeply thereafter. These results were obtained, however, when tests were administered under untimed conditions that were in contrast to the previous work cited. Response speed has been, in fact, a point of controversy that still persists. Some researchers consider it an important aspect of cognitive functioning (e.g., Botwinick & Storandt, 1973) whereas others believe it to

be unimportant (e.g., Green, 1969; Schaie, 1974).

The majority of the investigations of the relationship between age and cognitive functioning have been based on research designs that are cross-sectional. These studies have been criticized because they confound individual age-related changes and generational changes (cohort effects). To resolve this problem longitudinal studies have been used in an attempt to isolate ontogenetic cognitive patterns and changes. Findings of these studies are reviewed by Botwinick (1977) and Denney (1982) and indicate that whereas the same pattern of change in verbal and performance abilities is found as in cross-sectional studies, cognitive decline consistently occurs much later in life, and in some instances abilities actually show an increase. However, Botwinick (1977) suggests that this apparent "reversal of age changes" is a distortion caused by selective dropout (where a much higher percentage of subjects with superior intelligence remain available for retesting). He was able to demonstrate this effect arithmetically with findings in Schaie's cross-sequential studies (Schaie & Labouvie-Vief, 1974; Botwinick, 1977). In summary, on the basis of existing research evidence it is not possible to determine the extent of individual differences in cognitive abilities resulting from age. There does seem to be convincing evidence from cross-sectional and longitudinal studies that individuals whose cognitive abilities are very high when young are also very high when old (Baltes, et. al., 1972; Riegel & Riegel, 1972).

Cognitive functioning has also been assessed through procedures involving other than standardized intelligence measures. For example, a number of researchers have used specific problem solving tasks. Such tasks frequently involve concept search and identification. In a concept search task, the subject is asked to search for an unknown concept, chosen by the researcher, by

asking the least number of questions that assist in the search, or a subject is asked to select the "correct" stimulus from as few as possible stimulus alternatives. In addition, researchers have used anagram tasks, verbal and non-verbal reasoning tasks, matching figures tasks, and others. The results consistently indicate that older subjects perform less well than younger subjects (e.g., Arenberg, 1968; Brinley, et. al., 1974; Carpenter, 1971; Hayslip & Sterns, 1979).

Many researchers, however, have seriously questioned the relevance of the various problem solving tasks used in laboratory research (e.g., Arenberg, 1974; Capon & Kuhn, 1979; Denney & Palmer, 1981; Labouvie-Vief & Chandler, 1978; Schaie, 1974; Sinnott, 1975). Arenberg (1968) made tasks increasingly more concrete (from geometric stimuli to the subject of poisoned food). Denney and Palmer (1981) designed and administered nine real life problems together with a traditional concept search task. These researchers found that subjects did better on concrete, real life problems than on the traditional problem solving tasks.

Still another approach to the study of cognitive functioning among older adults has been the adoption of Piaget's model of cognitive development. Since Piaget postulated that mastery of formal operations is achieved in late adolescence or early adulthood, some researchers have drawn a parallel between this model and the concept of fluid intelligence, assuming a decline in formal operations somewhere in adulthood (Storck, et. al., 1972). Thus a number of researchers have administered to elderly subjects Piagetian tasks such as classification, class inclusion, and conservation tasks that Piaget had designed for children to determine whether they had achieved the level of concrete oeprations (e.g., Denney & Cornelius, 1974; Denney & Lennon, 1972, Papalia,

1972; Rubin et. al., 1973; Selzer & Denney, 1980). The findings have been inconsistent. Sinnott (1975) administered formal operational tasks to young and old adults and showed that formal operations are significantly affected by level of education. This would indicate a strong correlation of formal operational thinking with crystallized rather than fluid intelligence.

In an effort to use tasks that are more meaningful to elderly subjects Capon & Kuhn (1979) for example, adopted a formal operational Piagetian task involving proportional reasoning to a supermarket prudent shopping task. Sinnott (1975) was able to show that the performance of her younger adult subjects increased by ten percent when the problems were everyday kinds of problems, whereas the increase was 25 percent for her older subjects. In general, the results indicate that older adults solve concrete, everyday problems more easily than abstract problems.

A final approach to cognitive functioning that is considered in this paper is the conceptualization of cognitive functioning as creative thinking ability based on Guilford's (1959) model of intelligence. The results of research studies using this approach show older adults performing less well than young adults on measures of creative thinking abilities (Alpaugh & Birren, 1977; Alpaugh et. al., 1982; Ripple & Jaquish, 1981). Unfortunately, the measurement instruments used in these studies were the Torrance Tests (1962) which were designed for children and adolescents with many of the items appearing to be inappropriate for adults. Furthermore, the level of education of the participants was found to be highly correlated with the creative thinking performance (Alpaugh et. al., 1982; Ripple & Jaquish, 1981).

Based on the research literature, then, what conclusions can program developers draw regarding cognitive functioning of older adults? Two tentative

interpretations might be offered. First, today's older adults do less well than younger adults on standard intelligence tests especially on performance tests. Second, older adults generally do less well than younger adults on most problem solving tasks administered in the laboratory, including traditional problem solving tasks, Piagetian tasks, and creative thinking tasks. The implications of these results for educational programs must be viewed very cautiously in light of several serious questions concerning the conceptualization of cognitive functioning and concerning methodological limitations.

Among the problems with current research studies investigating age-related cognitive declines are the following: First, serious questions can be raised regarding the research designs commonly used in the study of older adults. As Schaie (1974) pointed out, cross-sectional studies may largely assess cohort or cultural differences rather than individual age-related differences in cognitive abilities. On the other hand, longitudinal research design has a serious problem resulting from high attrition rates among older populations. Furthermore, in cross-sectional studies it may be inappropriate to compare today's elderly with today's youth. Today's elderly grew up in an era with considerably less formal education for all, especially for women (who make up the majority of the samples in aging studies), a period without the benefits of television and fewer other means of public education and information. Further, research has demonstrated conclusively that education is an important correlate of cognitive abilities in studies that considered this variable (e.g., Birren & Morrison, 1961; Blum & Jarvik, 1974; Denney, 1979; Denney & Palmer, 1981; Gonda et. al., 1981; Green, 1969; Kesler, Denney, & Whitely, 1976; Ripple & Jaquish, 1981; Schaie & Strother, 1968; Selzer & Denney, 1980).

A second important limitation associated with many of the current research studies with the elderly is the relevancy of the tasks that participants have been asked to perform. It has been suggested that poor performance of older persons compared to young adults may be directly attributed to the irrelevancies or abstractness of the tasks presented by the laboratory researchers (Arenberg, 1968, Denney & Palmer, 1981; Sinnott, 1975). Whereas the abstractness of the task may be appropriate for a carefully controlled experiment, the generalizability of the results to real-life educational programs is highly questionable. Motivational factors such as interest and personal meaning have been shown to be associated with task relevance (Alpaugh, et. al., 1982; Taub, 1980). Furthermore, other personality factors such as cautiousness, test anxiety, fear of failure, self doubt, and cognitive style preference which seem to affect the elderly to a greater extent than the young (Alpaugh & Birren, 1977; Botwinick, 1966; Klein, 1972; Okun & di Vesta, 1976; Peterson & Eden, 1981) offer still other explanations for low performance by the elderly on cognitive functioning tasks.

Finally, a third limitation found in many performance related research studies is the emphasis placed on speed. As noted earlier, Schaie and his associate (Schaie & Strother, 1968) have found that subjects performing without time constraints do substantially better on a task involving spatial abilities than do others under timed conditions. It has also been noted that researchers often disagree on the function of speed in the assessment of cotnitive abilities. Whether or not speed is an important aspect of cognitive ability and whether or not older subjects are able to perform cognitive tasks rapidly may be of great theoretical interest and importance, but for the practicioner, these questions are far less important. A characteristic of aging is the general slowing-down of a number of functions. A slowing of

cognitive performance is consistent with this pattern. Besides, unlike most other adults, old persons typically do not lack in time.

Before addressing the question on learning a concluding comment needs to be made regarding the permanence of the cognitive functioning decline. Can the cognitive abilities of older subjects be improved through training? This question has, in fact, been investigated in laboratory studies. Denney (1979) has provided a careful review of this research. She reports that the effectiveness of six techniques for facilitating problem solving performance among older persons has been explored. These techniques were modelling, direct instruction, feedback, practice on similar problems, change of response speed, and other noncognitive techniques such as motivation and self-confidence. Denney concluded that, overall, these techniques, except for the noncognitive ones, appear to be rather effective. Thus, if there are indeed cognitive deficits among elderly persons, the evidence suggests that most, if not all, can be at least partially alleviated.

It, therefore, seems appropriate to conclude that developers of educational programs need not be overly concerned with serious cognitive deficiencies among older adults. They should expect the older participants in their programs to be as competent as those of the younger ages.

Learning and Memory

A second important area about which practicioners are particularly concerned is the possible development of limitations in learning and memory that might be associated with the aging process. Of concern to them is the question: Is there any experimental evidence that indicates that elderly individuals are limited by age in what they can be expected to learn and remember?

Interest in memory has a long history in psychology and research in this area with older persons has received a great deal of attention. To study the effects of aging on memory, researchers have frequently used learning tasks that involve word lists (e.g., Kausler & Lair, 1966; Hultsch, 1969; Eber, 1974) or digit span e.g., Arenberg, 1968; Keevil-Roger & Schmore, 1969). Generally, these tasks require the older persons either to recall (Hultsch, 1969, 1971) or to recognize (Eber, 1974; Kausler & Klein, 1978; Perlmutter, 1979) the material that was learned. Greater deficits have been found for the recall tasks than for the recognition tasks. However, some researchers have found results in conflict with this generalization. For example, Hultsch (1969) found no deficits among three age groups having high verbal skills, and Eber (1974) found an age-related decrement in a difficult recognition task.

Studies on memory or learning with the elderly have focused on a number of different issues such as incidental/intentional learning (Bromley, 1958; Perlmutter, 1979); interference caused by irrelevant cues (Rabbitt, 1965; Eber, 1974; Kausler & Klein, 1978); the use of mediators (Kausler & Lair, 1966; Hulicka & Grossman, 1967) and the effect of organizational structure in the learning task (Hultsch, 1969, 1971). The results of these studies have generally provided evidence supporting the hypothesis that memory and learning abilities decline with age.

Both Bromley (1958) and Perlmutter (1979) found a decline in intentional learning with age and whereas Bromley also found a decline in incidental learning, Perlmutter did not find a decline in an incidental recognition task. Regarding learning interference, Rabbitt (1965) used letters of the alphabet, whereas Eber (1975) and Kausler & Klein (1978) used words in their respective learning tasks to show that recognition skills of older persons are reduced

in the presence of irrelevant cues in comparison to younger participants.

Kausler & Lair (1966) and Hulicka & Grossman (1967) studied the use of mediators in a paired associate learning task, and found that elderly participants do not use mediators as frequently as do the younger subjects. Furthermore, with word pairs having high associative value Kausler & Lair found no difference between the age groups studied.

Finally, in the area of organizational structure of learning tasks, Hultsch (1969) found verbal recall decrements among subjects of low verbal fluency in free recall tasks, but not when subjects were allowed to alphabetize the words to be learned. In a later study, the same researcher (Hultsch, 1971) found that young subjects (20-29 years old) recall significantly more words than older subjects (60-69 years old) when participants are permitted to sort the words in the learning list. When subjects were not permitted to sort the words, significantly fewer words were recalled by middle and old participants (40-49 years old and 60-69 years old) than by younger subjects (20-29 years old). The authors concluded that the results supported the hypothesis of a "greater age related decrement in memory performance under conditions that minimize the opportunity for meaningful organization than under conditions that maximize such opportunity."

Whereas some researchers have attempted to draw implications for elderly adult education programs from these and other laboratory studies (Okun, 1977; Glynn & Muth, 1979) others have questioned the interpretation of the findings (Schaie, 1974) as well as the generalizability of laboratory results to non-laboratory settings (Rothkopf, 1972; Taub, 1980). Schaie, for example, argued that differences in learning and memory among young and old adults can be explained by methodological factors such as cohort effects and personality

factors. Rothkopf on the other hand criticized laboratory tasks used to study learning and memory research as unrepresentative of the behaviors required of the elderly enrolled in educational programs. In particular Rothkopf identified learning word lists and rate of learning as highly artificial procedures. More recently Taub has questioned the generalizability of laboratory research involving word lists and suggested the need for research studies in learning and memory with elderly adults using meaningful prose material. The critics, therefore, have suggested that the question of interest for program developers is whether there is a decline with age in the ability to learn and remember concepts when these are presented through a written prose passage.

Although not as extensive as the research studies using word lists and digit spans, there have been a number of studies reported in the literature that have focused on differences between young and old persons on learning and memory when material is presented through a written prose format. The results of these studies have been mixed. Some investigators have found an age-related decline in memory using meaningful prose passages similar to those declines identified in research studies using word lists (Moenster, 1972; Gordon & Clark, 1974; Taub, 1979; Dixon, Simon, Nowak & Hultsch, 1982). On the other hand other researchers have not shown a significant difference between young and older adults when using meaningful prose material (Taub & Kline, 1978; Taub, 1979; Meyer & Rice, 1981; Cerella, Paulslock & Poon, 1981; Simon, Dixon, Nowak & Hultsch, 1982). The lack of consistency in this literature is difficult to explain. Each study investigated the problem differently. The tasks required of the participants were different (i.e., to recall as much of the passage as possible, or to answer specific questions about the passage).

The length of the passages differed, with most researchers using material having less than 200 words and none using material longer than 700 words. Among the studies reviewed, only two findings were replicated. Both Moenster (1972) and Taub (1979) provided evidence to indicate that the older participants do not learn or comprehend the prose passage as well as the younger subjects. The second consistent finding was that older and younger individuals who have high verbal fluency do not differ regarding their learning and recalling of meaningful prose material (Taub, 1979; Meyer & Rice, 1981).

Thus the research literature does not provide a clear answer to program developers as to whether there is a decline in memory of information provided through a written prose format.

As is the case with the research on cognitive functioning, the research on learning and memory has several serious methodological problems that limit the generalizability of the laboratory research for applied educational programs involving the elderly. The most serious weakness in the studies reviewed involves the research task. As noted earlier, several researchers questioned the usefulness of learning and memory studies involving word lists and digit spans. Their solution has been to encourage the use of meaningful prose material. Unfortunately, the "meaningful" prose passages that have been used in recent research typically involve paragraphs of less than 200 words. Research tasks involving such short passages are only a little more meaningful than word lists. Generalizing the results from such short learning activities to required learning activities in educational programs is probably no more appropriate than generalizing the results from studies using word lists.

A second problem with many of the research studies using meaningful prose material is the method used to assess learning and memory. Many studies required the recall of as much of a passage as possible. Then the number of words or idea units stated are counted and comparisons mean between young and older participants. Such tasks seem irrelevant from the perspective of understanding what was read. On occasion, researchers have asked questions regarding the content of the passages read. This seems to be a more relevant measure of learning and understanding.

A third issue that is often ignored by researchers using meaningful prose material involves the readability levels of the learning passage and the reading levels of elderly participants. The consistent finding of no difference among highly verbal older and younger participants, but differences among low verbal individuals may reflect differences in reading ability rather than learning ability. Taub's (1978) study of comprehension showing that the elderly participants appear to comprehend less than the younger participants may be the result of poor reading ability rather than poor comprehension.

Finally, researchers interested in studying learning and memory effects with the elderly should consider the educational significance of the observed differences. Even if there were statistically significant age related deficits in memory, those differences may not have any practical significance from the perspective of learning in an educational setting.

Conclusion

In conclusion, it is suggested that the laboratory research on learning and cognition among the elderly is a first step in a process of gathering information

about the subject. It must be followed by research conducted in the field where learning abilities and cognitive functioning are assessed in the actual educational setting. Whereas this may be more difficult and more complex than laboratory research, its rewards come from being able to obtain data that are externally more valid and more useful. Finally, educators of older individuals, just as those of younger adults and children, should carry out diagnostic evaluations of their students' unique characteristics regarding abilities, needs, interests, and goals as a basis for designing instructional programs.

References

Alpaugh, P.K., & Birren, J.E. Variables affecting creative contributions across the adult life span. Human Development, 1977, 20, 240-248.

Alpaugh, P.K., Parham, I.A., Cole, K.D., & Birren, J.E. Creativity in adulthood and old age: An exploratory study. Educational Gerontology, 1982, 8, 101-116.

Arenberg, D. A longitudinal study of problem solving in adults. Journal of Gerontology, 1974, 29, 650-658.

Arenberg, D. Concept problem solving in young and old adults. Journal of Gerontology, 1968, 23, 279-282.

Arenberg, D. Input modality and retention. Journal of Gerontology, 1968, 23, 462-465.

Baltes, P.B., Nesselrode, K., Schaie, K.W., & Labouvie-Vief, G.V. On the dilemma of regression effects in examining ability-related differentials in ontogenetic patterns of intelligence. Developmental Psychology, 1972, 6, 78-84.

Birren, J.E., & Morrison, D.F. Analysis of the WAIS subtests in relation to age and education. Journal of Gerontology, 1961, 16, 363-369.

Blum, J.E., & Jarvik, L.F. Intellectual performance of octogenarians as a function of education and initial ability. Human Development, 1974, 17, 364-375.

Botwinick, J. Cautiousness in advanced age. Journal of Gerontology, 1966, 21, 347-353.

Botwinick, J., Storandt, M. Speed functions, vocabulary ability, and age. Perceptual Motor Skills, 1973, 36, 1123-1128.

Botwinick, J. Intellectual abilities. In J.E. Birren, & K.W. Schaie (Eds.) Handbook of the psychology of aging. New York: Van Nostrand, 1977.

Brinley, J.F., Jovick, T.J., & McLaughlin, L.M. Age, reasoning, and memory in adults. Journal of Gerontology, 1974, 29, 182-189.

Bromley, D. Some effects of age on short term learning and remembering. Journal of Gerontology, 1958, 13, 398-406.

Capon, N., & Kuhn, D. Logical reasoning in the supermarket: Adult females' use of proportional reasoning strategy in an everyday context. Developmental Psychology, 1979, 15, 450-452.

Carpenter, W.L. The relationship between age and information processing capacity of adults. Industrial Gerontology, 1971, 8, 55-57.

Cattell, R.B. Theory of fluid and crystallized intelligence: A critical experiment. Journal of Educational Psychology, 1963, 54, 1-22.

Cerella, J., Paulshock, D., & Poon, L.W. The effects of semantic processing on memory of subjects differing in age. Educational Gerontology, 1981, 6, 1-7.

Denney, N.W. Aging and cognitive changes. In B.B. Wolman, & G. Stricker (Eds.) Handbook of developmental psychology. Englewood Cliffs, N.J.: Prentice-Hall, 1982.

Denney, N.W., & Cornelius, S. Class inclusion and multiple classification in middle and old age. Developmental Psychology, 1975, 11, 521-522.

Denney, N.W., & Lennon, M.L. Classification: A comparison of middle and old age. Developmental Psychology, 1972, 7, 210-213.

Denney, N.W. Problem solving in later adulthood: Intervention research. In P.B. Baltes & O.B. Brim (Eds.) Lifespan developmental behavior, Vol. 2. New York: Academic Press, 1979.

Denney, N.W., & Palmer, A.M. Adult age differences on traditional and practical problem-solving measures. Journal of Gerontology, 1981, 36, 323-328.

Dixon, R.A., Simon, E.W., Nowak, C.A., & Hultsch, D.F. Text recall in adulthood as a function of level of information, input modality and delay interval. Journal of Gerontology, 1982, 37, 358-364.

Doppelt, J.E., & Wallace, W.L. Standardization of the Wechsler Adult Intelligence Scale for older persons. Journal of Abnormal and Social Psychology, 1955, 51, 312-330.

Eber, J.T. Age difference in recognition memory. Journal of Gerontology, 1974, 29, 171-181.

Elias, M.F. Symposium -- The real world and the ivory tower. The Gerontologist, 1974, 14, 525-526.

Glynn, S.M., & Muth, K.D. Text-learning capabilities of older adults. Educational Gerontology, 1979, 4, 253-269.

Gonda, J., Quayhagen, M., & Schaie, K.W. Education, task meaningfulness, and cognitive performance in young-old and old-old adults. Educational Gerontology, 1981, 7, 151-158.

Gordon, S.K., & Clark, W.C. Application of signal detection theory to prose recall and recognition in elderly and young adults. Journal of Gerontology, 1974, 29, 64-72.

Green, R.F. Age-intelligence relationship between ages sixteen and sixty-four: A rising trend. Developmental Psychology, 1969, 1, 618-627.

Guilford, J.P. Traits of creativity. in H.H. Anderson (Ed) Creativity and its cultivation. New York: Harper, 1959, 142-161.

Hayslip, B., & Sterns, H.L. Age differences in relationship between crystallized and fluid intelligence and problem solving. Journal of Gerontology, 1979, 34, 404-414.

Hickey, T., & Spinetta, J.J. Briding research and application. The Gerontologist, 1974, 14, 526-530.

Horn, J.L. Human ability systems. In P.B. Baltes (Ed.) Life-span development and behavior, Vol. I, New York: Academic Press, 1978.

Horn, J.L., & Donaldson, G. On the myth of intellectual decline in adulthood. American Psychologist, 1976, 31, 701-719.

Horn, J.L., & Cattell, R.B. Age differences in fluid and crystallized intelligence. Acta Psychologica, 1967, 26, 107-129.

Hulicka, I.M., & Grossman, J.L. Age group comparison for use of mediators in paired-associate learning. Journal of Gerontology, 1967, 22, 46-51.

Hultsch, D.F. Adult age differences in free classification and free recall. Developmental Psychology, 1971, 4, 338-342.

Hultsch, D.F. Adult age differences in the organization of free recall. Developmental Psychology, 1969, 1, 673-678.

Kausler, D.H., & Klein, D.M. Age differences in processing relevant versus irrelevant stimuli in multiple-item recognition learning. Journal of Gerontology, 1978, 33, 87-93.

Kausler, D.H., & Lair, C.V. Associate strength and paired-associate learning in elderly subjects. Journal of Gerontology, 1966, 21, 278-280.

Keevil-Rogers, & Schnore, M.M. Short-term memory as a function of age in persons of above average intelligence. Journal of Gerontology, 1969, 24, 184-188.

Kesler, M.S., Denney, N.W., & Whitley, S.E. Factors influencing problem solving in middle-aged and elderly adults. Human Development, 1976, 19, 310-320.

Klein, R.L. Age, sex and task difficulty as predictors of social conformity. Journal of Gerontology, 1972, 27, 229-236.

Labouvie-Vief, G., & Chandler, M.J. Cognitive development and life-span developmental theory: Idealistic versus contextual perspectives. In P.B. Baltes (Ed) Life-span development and behavior, Vol. I. New York: Academic Press, 1978.

Meyer, B.J.F., & Rice, G.E. Information recalled from prose by young, middle and old adult readers. Experimental Aging Research, 1981, 7, 253-268.

Moenster, P.A. Learning and memory in relation to age. Journal of Gerontology, 1972, 27, 361-363.

Morgan, A.B. Differences in logical reasoning associated with age and higher education. Psychological Reports, 1956, 2, 235-240.

Mouge, R.H., & Hultsch, D.F. Paired-associate learning as a function of adult age and length of anticipation and inspection intervals. Journal of Gerontology, 1971, 26, 157-162.

Okun, M.A. Implications of geropsychological research for the instruction of older adults. Adult Education, 1977, 27, 139-155.

Okun, M.A., & di Vesta, F.J. Cautiousness in adulthood as a function of age and instructions. Journal of Gerontology, 1976, 31, 571-576.

Papalia, D.E. The status of several conservation abilities across the lifespan. Human Development, 1972, 15, 229-243.

Perlmutter, L.C. Free recall, cued recall and recognition. Journal of Gerontology, 1979, 34, 533-539.

Peterson, D.A. & Eden, D.Z. Cognitive style and the older learner. Educational Gerontology, 1981, 7, 57-66.

Rabbitt, P.M. An age decrement in the ability to ignore irrelevant information. Journal of Gerontology, 1965, 20, 233-238.

Riegel, K.F., & Riegel, R.M. Development, drop and death. Developmental Psychology, 1972, 6, 306-319.

Ripple, R.E., & Jaquish, G.A. Fluency, flexibility, and originality in later adulthood. Educational Gerontology, 1981, 7, 1-10.

Ross, E. Effects of challenging and supportive instructions on verbal learning in older persons. Journal of Educational Psychology, 1968, 59, 261-266.

Rothkopf, E.Z. Structural text features and control of processes in learning from written materials. In J.B. Carroll & R.O. Freedle (Eds.) Language comprehension and the acquisition of knowledge. Washington, D.C.: V.H. Winston & Sons, 1972.

Rubin, K.H., Attewell, P., Tierney, M., & Tumolo, P. The development of spatial egocentrism and conservation across the lifespan. Developmental Psychology, 1973, 9, 432.

Schaie, K.W. Rigidity-flexibility and intelligence: A cross-sectional study of the adult life span from 20-70. Psychological Monographs, 1948, 72, 9.

Schaie, K.W. Translations in gerontology: From lab to life -- Intellectual functioning. American Psychologist, 1974, 29, 802-807.

Schaie, K.W., & Labouvie-Vief, G.V. Generational versus ontogenetic components of change in adult cognitive behavior: A fourteen-year cross-sequential study. Development Psychology, 1974, 10, 305-320.

Schaie, K.W., & Strother, C.R. A cross-sequential study of age changes in cognitive behavior. Psychological Bulletin, 1968, 70, 671-680.

Selzer, S.C., & Denney, N.W. Conservation abilities among middle-aged and elderly adults. International Journal of Aging and Human Development. 1980, 11, 135-146.

Simon, E.W., Dixon, R.A., Nowak, C.A., & Hultsch, D.F. Orienting task effects on text recall in adulthood. Journal of Gerontology, 1982, 37, 575-580.

Sinnott, J.D. Everyday thinking and Piagetian operativity in adults. Human Development, 1975, 18, 430-443.

Storck, P.A., Looft, W.R., & Hooper, F.H. Interrelationships among Piagetian tasks and traditional measures of cognitive abilities in mature and aged adults. Journal of Gerontology, 1972, 27, 461-465.

Taub, H.A. Comprehension and memory of prose materials by young and old adults. Experimental Aging Research, 1979, 5, 3-13.

Taub, H.A., & Kline, G.E. Recall of prose as a function of age and input modality. Journal of Gerontology, 1978, 33, 725-730.

Taub, H.A. Life-span education: A need for research with meaningful prose. Educational Gerontology, 1980, 5, 175-187.

Thurstone, L.L., & Thurstone, T.G. Primary Mental Abilities. Chicago: Science Research Associates, 1949.

Torrance, E.P. Guiding creative potential. Englewood Cliffs, N.J.: Prentice-Hall, 1962.

Urban, H.B., & Watson, W. Response to bridging the gap: Alternative approaches. The Gerontologist, 1974, 14, 530-533.

Wechsler, D. The Measurement and appraisal of adult intelligence. 4th edition. Baltimore, Md.: William & Wilkins, 1958.

Woodruff, D.S., & Walsh, D.A. Research in adult learning: The individual. The Gerontologist, 1975, 15, 424-430.